PB-229 762

STORET II: STORAGE AND RETRIEVAL OF DATA FOR OPEN WATER AND LAND AREAS

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Federal Water Pollution Control Administration
Washington, D. C.

1966

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Storage and Retrieval of Data for Open Water and Land Areas

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U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL
ADMINISTRATION
DIVISION OF POLLUTION SURVEILLANCE

STORET II

Storage and Retrieval of Data for Open Water and Land Areas

by DONALD P. DUBOIS, Chief, Data Operations

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
DIVISION OF POLLUTION SURVEILLANCE

Acknowledgments

A number of persons in many organizations have contributed ideas and provided guidance in the development of the system described in this publication. Too numerous to mention individually, they include representatives from state agencies and private organizations as well as from many activities in the Public Health Service and the Federal Water Pollution Control Administration.

Particular recognition is due Clarence W. Tutwiler who developed most of the techniques used in this system and who did all of the necessary computer programming. His analytic skill and ability to select and incorporate sound ideas into the system were most important in providing a smoothly functioning finished product.

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Chapter I INTRODUCTION

The increasing emphasis on improving America's streams, lakes, coastal waters, and groundwaters has spurred activities by local, State, Federal, and private groups in defining and measuring the pollution problem. In these activities large quantities of data are produced both by traditional techniques and by recently developed automatic monitoring systems.

A great deal of money is being spent in this effort and much more will be required to accomplish the necessary pollution abatement goals. Further effort will then be required to effectively manage complex river basin-wide control programs for maintaining high standards of water quality. In this overall effort a key element is the handling and processing of pertinent data and information in such a manner that they can be of the most use while at the same time keeping costs to a minimum.

Water pollution control personnel have been aware of the importance of sound data handling and processing systems for many years and in 1961 took the first steps toward the development of a comprehensive data storage and retrieval system utilizing digital computers. Early in 1964 the first element of the storage and retrieval system was placed in operation. This system, known as STORET Subsystem I, is described in the publication entitled, "The Storage and Retrieval of Data for Water Quality Control" by Richard S. Green. The system described herein is designated STORET Subsystem II and provides additional data-processing capabilities. Additional systems are under development to provide even more comprehensive capabilities.

Data storage and retrieval are not all that are required in the handling and processing of data required for water quality studies and management programs. Vitally important steps are the computation and summarization procedures required to discern meaning from the many individual facts available. Much effort is being expended in the development of statistical and other mathematical approaches to aid in the analysis of data. Plans are now being implemented for tying together the elements of data collection, storage, retrieval, and analysis in such a manner that the required information can be speedily delivered to those responsible for complex management programs.

Application of the System

STORET Subsystem II described in this manual consists of a series of related computer programs designed for the efficient storage and retrieval of data collected in connection with water quality management programs. The system utilizes latitude and longitude to identify the location of data collection points and is intended for use in handling data collected from large open bodies of water and from points on land areas which cannot be associated readily with points on a stream. STORET Subsystem I utilizes a stream mileage and indexing method of locating data collection points and is intended to remain as the primary system for storing and retrieving water quality data collected from streams. STORET Subsystem II, then, should be considered as a complementary system designed to serve in areas where STORET Subsystem I will not function effectively. Plans are under way to provide a link between the two Subsystems so that, as a secondary measure, it will be possible to retrieve data stored in STORET I by using the techniques of STORET II.

Since STORET I was placed in operation in the Spring of 1964, it has been used extensively for handling stream quality data by various Federal Water Pollution Control Administration study projects and to some degree by agencies outside the Administration. STORET II is expected to be widely used in studies of coastal and estuarine waters, groundwaters; and in areas such as large marsh or swamp areas where stream systems are interconnected in complex patterns.

Elements of the System

The basic elements of STORET II consist of: (1) procedures to identify and store data concerning the location of data collection points; (2) procedures to record and store water quality and related parameters; and (3) methods of retrieving the data in any one of several ways to best fit the needs of users. Latitude and longitude coordinates were chosen over other coordinate systems such as the Universal Transverse Mercator system to identify data collection points because of the general familiarity with latitude and longitude and the fact that most maps show these coordinates. Latitude and longitude figures are used in place of both the six-digit station number and the river mileage and index figures used in STORET I.

Variable water quality and related data are identified by the same five-digit parameter numbers used in STORET I. The use of parameter numbers in this manner allows wide flexibility in the storage and retrieval of the data and provides for essentially unlimited expansion in the number of different parameters which can be handled. As in STORET I, variable water quality values are recorded in a "floating point" format which permits the use of the same number of punch card columns to record widely varying parameter values.

Retrieval techniques incorporated in this system are designed to provide as much flexibility as is feasible for users of the system. Polygons may be specified and data from within the polygons then listed in any one of several orders. Capabilities of restricting retrieval to specified states, agencies, and types of stations within the specified polygons are also provided.

The all important capability of providing data in a format amenable for use as input to computational programs is included in STORET II. Most of the computational programs which have been developed recently for use with the STORET system, such as statistical analysis programs, will operate with full effectiveness using data retrieved from STORET II.

Chapter II DATA STORAGE

Data storage techniques for STORET II parallel the approaches used in STORET I. Basically, identifying information concerning the location of data collection points, then water quality and related data for the points are stored. There are some fundamental differences in data storage techniques, since latitude and longitude serve as both the station number and the basic station location data in STORET II and since 15 digits are required to report latitude and longitude. The figures designating latitude and longitude, together with some additional information are stored each time water quality data are stored. However, rather than use the large amount of space on each data card necessary to report latitude and longitude plus associated identifying information, all the identifying information for sampling points is entered on separate cards; then the water quality data cards are tied by an arbitrary number to the location cards. A second area in which STORET I and STORET II differ is that less emphasis is placed on the storage of descriptive material, such as basin designations, in STORET II. The capability is provided in STORET II for storing descriptive information, but its use is optional.

Location Data Storage

The basic elements used to identify the location of a data collection point are the latitude and the longitude of the point and the agency code for the sponsoring agency. A new station is created for each different combination of these three elements. Additional location and identifying information are stored for each station; however, new stations are not created by differences in this supporting information. Instead, an error condition is created if there are differences in this information and the data are not stored.

Header Cards I, III, IV, and V are used to store location and identifying information. Header Card I is always required while the use of Header Cards III, IV, and V is optional. These last three cards can be stored at any time, simultaneously with or following establishment of the station by Header Card I. Numbering of the Header Cards corresponds to comparable Location Cards in STORET I. The Header Card II designation is not used since there is no need for a card which corresponds with Location Card II.

The form shown in Plate 1 is available and should be used for recording location data.

Header Card I: Header Card I, represented in Figure 1, Appendix I must be completely coded the first time data are stored for a station. Columns 28 and 30–42 of this card should be left blank for all subsequent data storage runs and for all changes and deletions of variable data (see Chapter III). Detailed instructions for coding Header Card I are as follows:

1. Card Sorting Field (Columns 1–3)—The purpose of this field is to record an arbitrary number to tie together sets of Header Cards and Data Cards. This number will be used to reassemble the deck of Header Cards and Data Cards in case of an accident in which cards for a station become separated. The arbitrary three-digit number will not be stored by the computer. It is recognized that over a period of time the same arbitrary number will be assigned to different sets of data. This, however, should not present a problem since data will be placed on magnetic tape shortly after key punching and thus be made a part of the permanent record. Input cards will then normally be discarded.

2. Unused Field (Columns 4–6).

3. Location Field (Columns 7–21)—Used for locating the station by latitude and longitude. Unused portions of this field must be filled with zeros. It should be noted that both latitude and longitude are reported to the nearest 0.1 second.

4. Agency Code (Columns 22–27)—The code number of the agency or organization collecting the data for this station. Agency codes are enumerated in the publication entitled, "Agency Codes for the

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STORET II - LOCATION DATA

HEADER CARD I *(Required)*

CARD SORTING NUMBER _____ 1-3

4-6 BLANK

LATITUDE *(Degrees, Minutes, 0.1 Seconds)* _____ 7-13

LONGITUDE *(Degrees, Minutes, 0.1 Seconds)* _____ 14-21

AGENCY CODE _____ 22-27

PRECISION CODE *(Use for original storage only)* _____ 28

UNITS CODE FOR DEPTH *(F for Feet and M for Meters)* _____ 29

TOTAL DEPTH OF WATER OR WELL *(Use for original storage only)* _____ 30-32

STATE CODE *(Use for original storage only)* _____ 33-34

TYPE OF STATION CODE *(Use for original storage only)* _____ 35-42

43-67 BLANK

STATION CODE *(Optional, Left Justify)* _____ 68-79

1 80

HEADER CARD III *(Optional and Used for Original Storage Only)*

CARD SORTING NUMBER *(Same as Col. 1-3 on Card I)* _____ 1-3

4-12 BLANK

STATE NAME (13-28):

MAJOR BASIN NAME (29-52):

MINOR BASIN NAME (53-79):

3 80

HEADER CARD IV *(Optional and Used for Original Storage Only)*

CARD SORTING NUMBER *(Same as Col. 1-3 on Cards I and III)* _____ 1-3

4-6 BLANK

MINOR BASIN NAME - CONT. FROM CARD III (7-19):

LOCATION NAME (20-51):

LOCATION NAME - CONT.:

52-79 BLANK

4 80

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2-66

PLATE 1

STORET System" and are the same for both STORET I and II.

5. Precision Code (Column 28)—The following characters will be coded so as to indicate the precision of the method used for locating the station:

Code		*Station Located to Nearest:*
1	—	0.1″
2	—	1″
3	—	10″
4	—	30″
5	—	1′
6	—	10′
7	—	30′
8		1°

The precision code will be shown on the printout and in addition will cause the computer to omit inappropriate trailing zeros for latitude and longitude on the printout. See Appendix II for a table showing length of a degree of latitude and longitude.

6. Meters or Feet Field (Column 29)—Used to define the unit of measure (meters or feet) for the depth of water or well as recorded on Header Card I and the depth of observation shown on the Data Cards. An "M" is used to signify meters while an "F" designates feet.

7. Depth of Water or Well Field (Columns 30–32)—The total depth from ground surface of a well if a land station, or the total depth of a body of water at Mean Low Water (or Mean Lower Low Water) if a water station will be coded into this field. When the total depth of a body of water is subject to wide fluctations, as is the case for some reservoirs, a fixed datum should be established such as spillway elevation and this datum defined in the descriptive paragraph using Header Card V. Data in this field refer to the total depth and *not to the depth at which the sample was taken.* The units of this field are either meters or feet as defined by the Meter or Feet Field.

8. State Code (Columns 33–34)—The two-digit state code that is defined in Appendix III.

9. Type of Station Field (Columns 35–42)—An eight-digit code is used to allow up to 24 different types of stations. The thirteen codes assigned to date are described as follows:

Type of Station Code	*Description*
00000001	*Stations located offshore on nontidal waters. This code will be used for certain stations on lakes, reservoirs, etc.
00000002	Land stations such as wells.
00000004	*Stations located offshore on tidal waters. This code will be used for certain stations in bays, estuaries, and in the open ocean.
00000010	*Stations located nearshore on nontidal waters.
00000020	*Stations located nearshore on tidal waters.
00000040	Not Assigned.
00000100	Municipal raw water.
00000200	Municipal finished water.
00000400	Municipal untreated waste.
00001000	Municipal treated waste.
00002000	Industrial raw water.
00004000	Industrial finished water.
00010000	Industrial untreated waste.
00020000	Industrial treated waste.

*Nearshore is defined as within 100 meters of the shoreline *at the time of sample collection.* Offshore is defined as all other portions of the waterbody.

It should be noted that codes 00000001 through 00000020 apply to the *location* of water quality sampling stations while the remaining codes pertain to the *type* of water supply or waste disposal station. Codes 00000001 through 00000020 are designed to aid in data retrieval operations by making it unnecessary to carefully define retrieval polygons to select only shoreline data, groundwater data, etc. The codes should *not* be added together for station storage in an attempt to define, for example, data for treated municipal wastes discharged to offshore tidal waters.

10. Column 43–79—Blank except for changing data (see Chapter III), or when a station number is used to associate data cards with the proper latitude and longitude of the point. This station number

can be up to eight alphabetic characters or twelve numeric characters in length and is to be left justified in columns 68–79. The unused portion of the field is left blank.

11. Column 80—Always punch "1" to indicate Header Card I.

Header Card III: (Optional) Figure 2, Appendix I represents Header Card III. This card has four fields to be coded as follows:

1. Card Sorting Field (Columns 1–3)—See section entitled, "Header Card I."

2. Unused Field (Columns 4–12).

3. State or Other Description of Station Location (Columns 13–28).

4. Major Basin or Other Description of Station Location (Columns 29–52).

5. Minor Basin or Other Description of Station Location (Columns 53–79)—This field is continued on Header Card IV.

6. Column 80—Always punch "3" to indicate Header Card III.

Header Card IV: (Optional) Figure 3, Appendix I, represents Header Card IV. It has three fields to be coded as follows:

1. Card Sorting Field (Columns 1–3)—See section entitled, "Header Card I."

2. Unused Field (Columns 4–6).

3. Minor Basin or Other Station Location Description (Columns 7–19)—Continued from Header Card III.

4. Location Name (Columns 20–51)—Description of station location.

5. Columns 52–79 are not used.

6. Column 80—Always contains a "4" to indicate Header Card IV.

Header Card V: (Optional) Figure 4, Appendix I, represents Header Card V. It is used to store a paragraph describing the station. Up to eleven of these cards may be used for each station. The form shown in Plate 2 can be used to record data up to eleven Header Card V's. Coding is as follows:

1. Card Sorting Field (Columns 1–3)—See section entitled, "Header Card I."

2. Columns 4–6—Not used.

3. Descriptive Paragraph Field (Columns 7–78)—Used to store any desired descriptive information. Since 11 cards may be used, a total of 792 characters, are available for the descriptive paragraph.

4. Line Number (Column 79)—Each of the eleven cards forms one line of information on the printout. Codes for column 79 are 0 for line number one, 1 for line number two, etc., and J for line number eleven.

5. Column 80—Always contains a "5" to indicate Header Card V.

Water Quality Data Storage

The basic approach used in STORET I of a five-digit parameter number and storage of water quality values in terms of a floating point number with four significant digits is retained in STORET II. The same parameter numbers are used in both systems.

Water quality can be entered in STORET II using Data Cards of a format similar to the Parameter Cards used in STORET I. A second input method is to use fixed field cards designed specifically for input to the STORET system or designed for some other purpose. A third option permits use of a station number recorded directly on the Data Card.

Data Card: (See Figure 5, Appendix I). Data cards will be stored by placing them in a deck immediately following the Header Card(s) for the station. It should be recalled that only columns 1–27 and column 29 of Header Card I are to be coded after the original storage of location information. The form shown in Plate 3 is available and should be used to record data for punching on the data card. Coding for Data Cards is as follows:

1. Card Sorting Field (Columns 1–3)—See section entitled, "Header Card I."

2. Depth of Observation Field (Columns 4–6)—Depth from the water surface (or ground surface for land stations) to the point at which the sample was taken is to be coded in this field. Units for the depth are either feet or meters as specified in column 29 of Header Card I. To indicate a sample collected from the bottom of a lake, stream, etc., a "1" is to be coded in column 79 of the Data Card.

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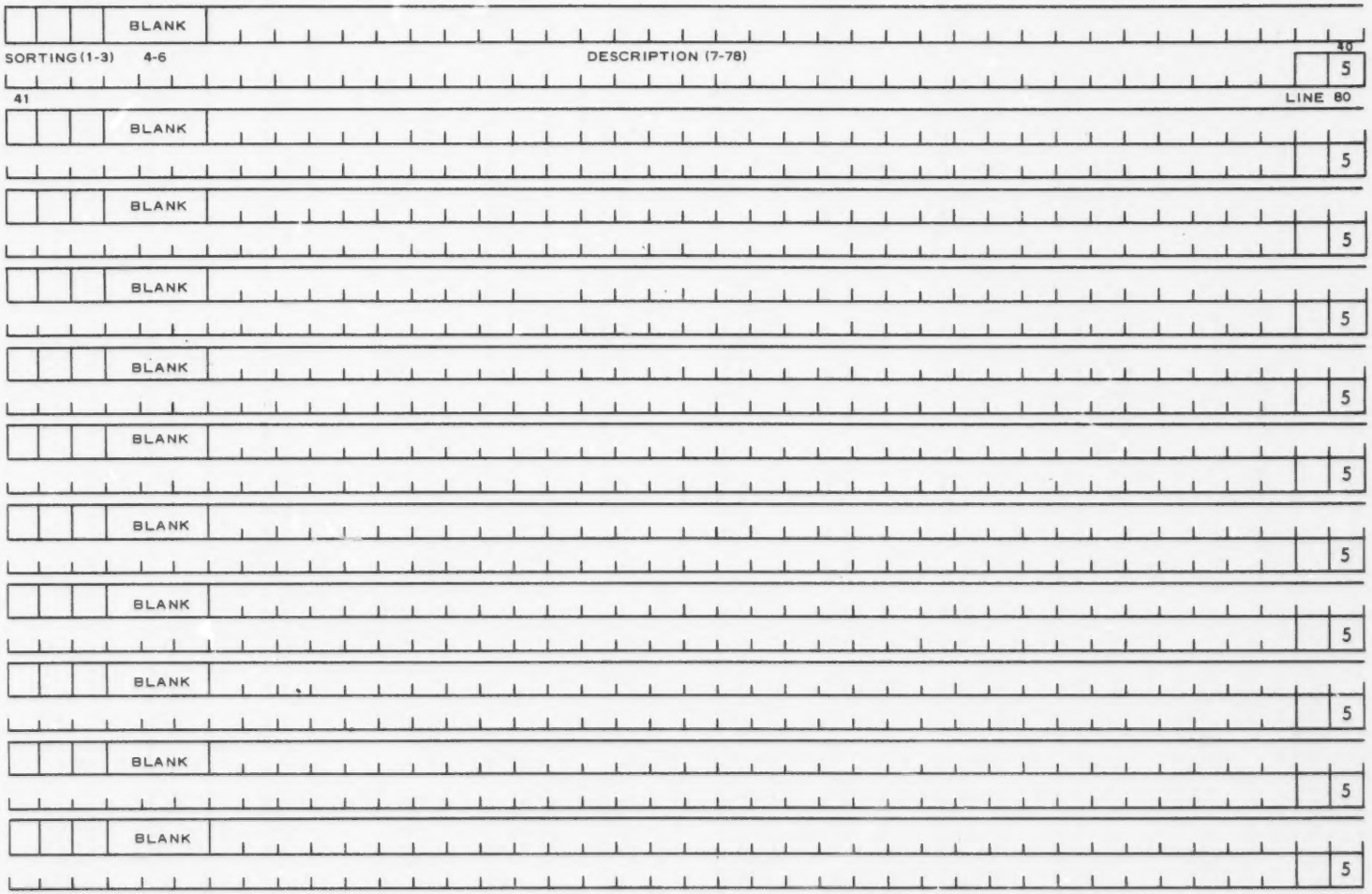
STORET II - HEADER CARD V



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2-66

PLATE 2

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

STORET II - WATER QUALITY DATA

LABORATORY BRANCH DATA	COMPUTER CODED DATA
LATITUDE, LONGITUDE, SAMPLE DEPTH — DATE OF SAMPLE YR. MO. DAY	SORTING # (1-3) SAMPLE DEPTH (4-6) YR. MO. DAY (7-12) (13-18)
HOUR & MINUTE OF SAMPLE OR LAST DATE OF COMPOSITE SAMPLE	
ITEM _____ UNIT _____	PARAMETER CODE (19-23) VALUE (24-27) EXP. (28-29) RMKS. (30)
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	(31-35) (36-39) (40-41) (42)
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	(43-47) (48-51) (52-53) (54)
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	(55-59) (60-63) (64-65) (66)
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	(67-71) (72-75) (76-77) (78) (79) BTM. (80) = 6
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	NEXT CARD - REPEAT COLUMNS 1-18 ABOVE
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	(19-23) (24-27) (28-29) (30)
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	(31-35) (36-39) (40-41) (42)
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	(43-47) (48-51) (52-53) (54)
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	(55-59) (60-63) (64-65) (66)
1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0	
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6	(67-71) (72-75) (76-77) (78) (79) BTM. (80) = 6

FWPCA - 2g
2-66

PLATE 3

3. Date Field (Column 7–12)—Date of collection of a grab sample or beginning date of a *standard* composite sample in year, month, day order. Different coding is used for this field where the *modified* composite sampling reporting procedure is used (see below).

4. Time or Composite End Date Field (Column 13–18)—This field can be coded in the following ways for grab samples or *standard* composite samples:

a. For grab samples where the time of collection is known, the hour (based on 24-hour day) and minute (based on 60-minute hour) are coded into columns 13–16.

b. The field is left blank if time data are not available.

For standard composite samples the year, month, and day of the final sample are coded into the field.

5. Parameter Code Fields (Columns 19–23, 31–35, etc.)—The five-digit code of the parameter in question is entered. (See "STORET System Parameter Code List" for a complete list of parameter codes.)

6. Significant Digits Fields (Columns 24–27, 36–39, etc.)—Enter four significant digits of the value of the parameter, assuming the decimal point to be at the left of all significant figures.

7. Exponent Fields (Columns 28–29, 40–41, etc.)—Enter an exponential value to give the proper location of the decimal point for the four significant figures of that parameter. The first exponential digit is 0 if exponential value is negative and 1 if exponential value is positive, the second digit is the exponential value itself.

8. Remark Fields (Columns 30, 42, etc.)—Up to 14 different remarks can be coded in these columns. If no remark is needed, the column is left blank. Typical remarks that might be needed, and their corresponding codes are as follows:

Punch	*Printed Output*	*Remarks*
0	J	Estimated value.
1	K	Actual value is known to be less than value given.
2	L	Actual value is known to be greater than value given.
3	M	Presence of material verified but not quantitated.
4	N	Presumptive evidence of presence of material.
5	O	
6	P	
7	Q	
8	R	
9	#	
2, 8*	$	
.	*	
@	"	

*Double punch 2 and 8 in same card column.

Additional remarks will have codes assigned to them as dictated by experience in the use of the system.

9. Bottom Sample Field (Column 79)—Code with a "1" for samples collected at the bottom of a body of water. The field is to be left blank for all other cases.

10. Column 80 always contains a 6.

If the significant digits columns of a quality parameter field are left blank, then this field is skipped and is not stored by the storage program. This option is useful when the same analyses are to be repeated on many samples. In this case the parameter cards can be gang punched with selected parameter codes previous to the value coding, thus making the parameter card a fixed field card and, therefore, easier to code. A second option incorporated in the storage program is useful if the parameter values may always be expressed using the same exponent without losing significant figures, thus permitting a single exponential code to be used for all values of this parameter. Thus, the following values:

	Significant Digits	*Exponent*		*Significant Digits*	*Exponent*
1 can be	0001	14	as opposed	1000	11
10 coded as:	0010	14	to:	1000	12
100	0100	14		1000	13
900	0900	14		9000	13
9009	9009	14		9009	14

Both methods of coding would be correct, and either could be used. In general practice the second method would normally be selected.

Modified Composite Coding Procedure: The coding procedure for the Data Card is different than

described above when it is desired to use the *modified* procedure for coding composite samples. The *modified* procedure allows storage of more detailed information than is possible using the *standard* procedure. Coding of the Data Card is as follows:

1. Card Sorting Field (Columns 1-3) and Depth Field (Column 4-6)—Same as for *standard* composite samples.

2. (Columns 7-12)—*Ending* year, month, and day of composite sample.

3. (Columns 13-16)—*Ending* hour and minute of the composite sample.

4. (Column 17)—Code with:

a. "S" for space composite

b. "T" for time composite

c. "B" for samples that are both space and time composites.

5. (Column 18)—Code with:

a. "Blank"—Composite samples for which a single set of analyses is made after the compositing process has been completed.

b. "A"—Computer average value of several individual samples or average value of a continuous record.

c. "H"—Maximum value of several individual samples or the maximum value of a continuous record.

d. "L"—Minimum value of several individual samples or the minimum value of a continuous record.

6. (Columns 19-23)—*Beginning* date of a composite sample. The date will be shown with five digits by recording the last digit only of the year, the month number, and the day number.

7. (Column 24)—Coded with a "C" in all cases.

8. (Columns 25-28)—*Beginning* hour and minute of a composite sample.

9. (Columns 29-30)—Code with:

a. CΔ—(where Δ is a blank) for samples collected continuously.

b. GΔ—Composite sample made up of individual grab.

c. NN—(where NN is a two-digit number such as 04 or 12) used to report the number of grab samples comprising a composite date.

d. ΔΔ—Columns can be left blank.

If the *modified* composite sample procedure is used, data for only four parameters can be stored on the first Data Card. When it is necessary to store data for more than four parameters for a sample, additional Data Cards will be required. Each of these additional cards can store five parameters as long as columns 1-18 contain exactly the same information as the first parameter card for the sample. In other words, the detailed data on composite samples contained in columns 19-30 need be recorded only once for each composite sample, no matter how many analyses are made.

Storage of Data Using Fixed Field Cards: A procedure has been provided for reading punched cards in a variety of formats and storing the data in the STORET system. This mechanical transfer of data can be accomplished where the fixed field card approach is used for the handling of parameter values, and where stations and dates can be identified by a specific code. It is necessary that the code for a station be unique within the group of stations covered by a particular card format and that it be less than eight alphanumeric characters or twelve decimal digits in size. It is also required that each fixed field data card be coded with the station number and date. The format of the fields for recording parameter values is variable depending upon the needs of the user. Users must specify the field location, size, content, and any special punches at the time data from fixed field cards are to be stored.

Before fixed field data can be stored, a station conversion table must be prepared. This table consists of cards in which the latitude, longitude, and agency code are coded into columns 7-27 and where the unique station code as found on the data cards is coded in columns 68-79. This station conversion card is very similar to Header Card I. In fact, by coding columns 68-79, Header Card I can be used for two purposes: (1) to store the station data and (2) as a station conversion card. In using this data storage technique the Header Cards need to be prepared only once.

Use of Station Number on Data Card: Columns 1-3 on the standard Data Card (Figure 5, Appendix I) can be used as a alphabetic or numeric station

number rather than as a card sorting number. This procedure involves storing the location information for a point using Header Cards I, III, and IV; storing a conversion table which relates the three digit station number with the location data; then storing Data Cards *without the associated Header Card I* as is required with the standard procedure. Columns 68–70 of Header Card I can be used to enter the three digit station number for preparation of the conversion table. It is necessary that the three digit station number be unique for each point for any one user of the STORET system.

Storage of Parameter Abbreviations

A Parameter Abbreviation Card (not shown in Appendix I) is used to store the parameter abbreviations used as column headings on the data printout and to locate the decimal point for data in the printout. These parameter abbreviations are stored for all parameters presently in use. Members of the staff at the computer center will prepare these cards for all additional parameters as needed and assigned.

Chapter III DELETING AND CHANGING DATA

In any procedure for storing and retrieving data it is important to be able to delete or change data already stored if errors are discovered or if outdated descriptive information must be replaced. Several methods of deleting and changing data have been provided in STORET II.

Parameter Data

Note: The cards described in the following section must be placed immediately after Header Card I in all operations involving changes and deletions.

1. To delete *all data* for a given station, date, and time, columns 1–18 of the Data Card are punched with a card sorting number plus the appropriate depth, date and time information of the data to be deleted. For modified composite samples, columns 1–18 are punched as described in Chapter II. Columns 19–21 of the Data Card are coded with the characters DEL.

2. To delete *an individual parameter* for a given date, the Data Card is punched as if data were being stored except that a D is punched in the left-hand column of the significant-digits field. All fields of those cards where numbers appear in the significant-digits columns are treated as valid data and the information contained in these fields will be stored. This permits the deletion of one or more individual parameter values and, if desired, the replacement of the deleted values with new figures in the same storage run. The replacement values need not be on the same cards which bear the pertinent D punches.

3. Where a relatively large amount of data must be replaced with new values, the above described method is somewhat cumbersome. If column 80 of a Data Card is punched with the letter C, data for all parameters on that card, and also the data for parameters contained by all other cards for that storage run for the same station and date, will be stored in place of, or merged with, old data.

4. If it is desired to delete all data for all dates for a station, but retain the station itself in the system, the following procedure is to be used:

a. Punch columns 1 through 3 of the Data Card as usual. Leave columns 4 through 6 blank.

b. Punch DELETE D in Columns 7 through 14 of the Data Card.

c. Punch 6 in Column 80.

Station Data

To delete all station data and *all parameter data* for *all dates* associated with this station, use the following procedure:

a. Punch Columns 7–27 of Header Card I with the latitude, longitude, and agency code of the station.

b. Punch DELETE S in columns 28–35 of Header Card I.

c. Code a 1 in column 80.

While data stored in columns 28–42 of Header Card I and in Header Cards III, IV, and V are more or less permanent in nature, the system user must still be able to change this information.

1. To change information contained by columns 28–42 of Header Card I:

a. Code columns 7–27 of Header Card I with the latitude, longitude, and agency code of the station.

b. Code columns 28–42 with the revised information.

c. Code the characters CHANGE in columns 43–48.

d. Punch the numeral "1" in column 80.

2. To change any or all information on Header Cards III and IV:

a. Punch columns 7–27 of Header Card I with the latitude, longitude, and agency code of the station.

b. Punch columns 43–48 of Header Card I with the characters CHANGE.

c. Punch the numeral "1" in column 80 on the above card.

d. Completely recode Header Cards III and IV in the desired manner. It is necessary to recode Cards III and IV completely even though only a portion of the information is to be changed.

3. To change all information resulting from the use of Header Card(s) V (the entire 792 character descriptive block), use the following procedure:

a. Punch columns 7–27 of Header Card I with the latitude, longitude, and agency code of the station.

b. Punch the word CHANGE in columns 43–48 of the above card.

c. Punch the number "1" in column 80 of the above card.

d. Leave column 79 of Header Card V blank and punch a new descriptive paragraph as desired. The recoding of information in the 792 character block can be done in conjunction with the recoding of columns 28–42 of Header Card I, and/or Header Cards III and IV, or it can be done independently.

4. To change individual lines of information in the 792 character block while leaving the remaining information unchanged, use the following procedure:

a. Punch columns 7–27 of Header Card I with the latitude, longitude, and agency code of the station.

b. Punch the word CHANGE in columns 43–48 of the above card.

c. Punch the number "1" in column 80 of the above card.

d. Punch the desired new information on Header Card V and punch column 79 of Header Card V with proper number to show which line is being changed. The proper numbers for punching in column 79 are: 0—to change line number 1; 1—to change line number 2, etc., and "J" to change line number 11.

Chapter IV DATA RETRIEVAL

After the information contained on the Header Cards and Data Cards has been stored on magnetic tape, a retrieval routine is used to obtain printouts in either or both of the formats indicated by Plates 4 and 5. Magnetic tape outputs of the retrieved data can also be obtained for use in further computer processing. The preferred procedure for retrieving data is to submit all necessary information as described in this Chapter in written form to personnel at the computer center. The personnel at the computer center will prepare and assemble the necessary punched cards and complete the retrieval operation.

The printout shown on Plate 4 contains fixed information about a station; i.e., that information which is stored by use of Header Cards I, III, IV, and V. Water quality data for an individual sampling station are printed in the format given by Plate 5. This type printout locates each value vertically under its abbreviation and horizontally from the date, time, and depth of sample. Decimal points for all values of a single parameter are located in the same column. With the exception of those which are whole numbers, values are limited to seven decimal digits; eight decimal digits are available if values are whole numbers, with no decimal point showing.

The remark code which is stored with the parameter value will be converted to a letter code by the retrieval program and printed to the right of the individual values. Letters are used instead of numbers, since this code must be distinguishable from the parameter value. If no remark has been coded, the remark column will remain blank.

Parameter Control Card

Parameters to be retrieved will be controlled by use of the Parameter Control Card (Figure 6, Appendix I). Column 1 of this card is always coded with a zero and the code numbers of the parameters to be retrieved are coded in fields I-X in the same

RETRIEVAL DATE: 07/26/66

LATITUDE: 46 54 30 LONGITUDE: 124 05 20
LOCATION NAME
STATE NAME
MAJOR BASIN NAME
MINOR BASIN NAME
AGENCY: 603200 TYPE: 00000004
DEPTH: 0035 FEET PRECISION: 3

DESCRIPTION

HARBOR AREA WATER QUALITY CONDITIONS WERE SURVEYED BY FWPCA DURING JULY 1966 TO DETERMINE PRESENT OR POTENTIAL EFFECTS OF WASTES ON THE SPORT FISHERY. TWELVE SAMPLES WERE TAKEN AT EACH OF TEN STATIONS DURING A ONE WEEK PERIOD. WASTES WHICH MAY ENTER THE HARBOR INCLUDE:

1. MUNICIPAL
2. DOMESTIC FROM SMALL BOATS
3. PULP AND PAPER
4. WOOD PRODUCTS
5. VEGETABLE PROCESSING
6. SEA FOOD PROCESSING
7. DRAINAGE FROM AGRICULTURAL AREAS

PLATE 4

RETRIEVAL DATE: 07/26/66

LATITUDE: 46 54 30 LONGITUDE: 124 05 20
LOCATION NAME
STATE NAME
MAJOR BASIN NAME
MINOR BASIN NAME
AGENCY: 603200 TYPE: 00000004
DEPTH: 0035 FEET PRECISION: 3

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH S U	39370 DDT WHL SMPL UG/L	39365 DDE WHL SMPL UG/L	39730 2,4-D WHL SMPL UG/L	31501 COLIFORM IMEDENDO MF/100ML	31616 FEC COLI M-FC44,5 MF/100ML		(PAR. NO.) ( ) (PAR ABBR) ( )
07 11 66	0700	0005	15.2	8.9	2.4	7.20	0.001K	0.000	0.000	850	220	-	DATA
	0705	0025	15.0	8.8	3.5	6.80	-	-	-	640	180	-	FIELD:
07 12 66	0910	0005	15.3	9.1	2.8	7.30	0.001K	0.000	-	1200	420	-	
	0910	0027	15.2	8.9	3.4	6.90	-	-	-	980	80	-	8 digits
07 13 66	1320	0006	15.3	8.4	5.0	7.10	0.007	0.001K	0.003	4560L	1420	-	including
	1320	0020	15.0	8.8	3.1	6.90	-	-	-	1150	430	-	decimal
07 14 66	1125	0004	15.6	8.5	4.8	7.20	0.001K	0.002	0.010	5220	1050	-	point
	1130	0025	14.9	8.7	2.9	6.80	-	-	-	1210	490	-	
07 15 66	1740	0005	15.3	8.9	3.1	7.00	0.001K	0.000	0.001K	2640	730	-	REMARKS
	1746	0027	14.7	8.5	2.9	6.70	-	-	-	670	90	-	FIELD:
07 16 66	1850	0006	15.1	9.0	1.9	7.20	0.001K	0.000	0.000	940	120	-	
	1853	0027	13.6	6.1	1.4	6.70	-	-	-	240	60	-	1 digit

PLATE 5

order that they are to be printed on the printout given in Plate 5. If certain fields are to be left blank in the printout, **99999** is coded in this field.

Since up to 50 parameters can be retrieved in one retrieval run, up to five cards of this type will be needed per run.

Station Control Card

The Station Control Card (See Figure 7, Appendix I) provides instructions to the retrieval program concerning the area(s) as defined by polygon(s) from which data are to be retrieved, order of listing the data on the printout, and state or agency restriction if any. Coding for this card is shown in the following sections.

1. Card Identification (Column 1)—Always code with a "2".

2. Agency or State (Columns 2–7)—Blank except when retrieval of data from within the specified area is to be restricted to those from within a state or to those data collected by certain agencies. For state limitations, Columns 2–3 are coded with the state code (see Appendix III for a list of state codes) and Columns 4–7 are left blank. Columns 2–7 are coded with the appropriate agency code for agency restrictions. An option is provided for entering only the first 1, 2, 3, 4, or 5 digits of an agency code and filling the remainder of the field with the alphabetic character "B". This causes the program to retrieve data for all agencies with common first, second, etc., digits in their agency codes. (Example: If columns 2–7 are coded 654BBB, data for all agencies with agency codes beginning 654 will be retrieved.)

3. Type of Retrieval and Order (Column 8)—Coding in this column governs 1) if stations in the interior or at the vertices of the polygons or both are to be retrieved; 2) whether or not data from several polygons are to be lumped together; and 3) the order in which the retrieved data are to be printed. Detailed coding of column 8 of the station control card is shown as follows:

Column 8 Code	*Stations Included*	*Order of Printing*
0	Interior and Vertices	longitude, latitude — data from multiple polygons mixed
1	Interior and Vertices	latitude, longitude — data from multiple polygons mixed
2	Interior and Vertices	longitude, latitude — data from multiple polygons separated
3	Interior and Vertices	latitude, longitude — data from multiple polygons separated
4	Interior and Vertices	distance from first coded vertex—data from multiple polygons separated
5	Interior and Vertices	distance from a reference point not one of the vertices (code first) — data from multiple polygons separated

Column 8 Code	*Stations Included*	*Order of Printing*
6	Interior and Vertices	distance from a point midway between the first two vertices—data from multiple polygons separated
7	Vertices only	longitude, latitude — data from multiple polygons mixed
8	Vertices only	latitude, longitude — data from multiple polygons mixed
9	Vertices only	order of storage of vertices —data from multiple polygons separated

NOTE: The codes 7, 8, and 9 can be used to retrieve data from one or more individual points.

4. Vertices of Polygons (Columns 9–80)—The polygon is defined by coding the remainder of Station Control Card with latitudes and longitudes of the vertices of the polygon *in that order.* Latitude and longitude values are separated by commas and the last longitude entry is followed by two commas to signal that the retrieval polygon has been completely coded. Latitude and longitude values for vertices are coded to the desired degree of precision by entering degrees; degrees and minutes; degrees, minutes, and seconds; or degrees, minutes, seconds, and tenths of seconds. Trailing zeros may be omitted. As an example, to retrieve a polygon with vertices at Lat. 30°15′, Long. 76°10′; lat. 30°05′; long. 77°05′; and lat. 39°30′05″, long. 76°40′15″, the coding beginning in column 9 of the Station Control Card would be as follows:

3015,761,3005,7705,393005,764015,, (remainder of card blank)

Leading zeros are required for reporting degrees for all latitudes and longitudes less than 20 degrees, but not for values equal to or greater than 20 degrees (Code 19°47′ as 01947 and 20°15′ as 2015).

When the number of vertices to be coded exceeds the space available on the first Station Control Card, a second, third, etc., card may be used to complete the polygon. The format of the second, third, etc. Station Control Cards is completely flexible with no predefined columns to allow continuation of coding begun on the previous card. Thus, column 1 of the second card can be considered as column 81 of the first card, etc. It is necessary that the user clearly indicate the proper order of the station control cards so that the proper retrieval polygon is defined.

The computer assumes that the last side of the polygon is a line drawn between the first vertex coded and the last vertex coded except when column 8 is coded with a 5. When column 8 is coded with a 5, the computer considers the first vertex to be the point from which the stations are to be ordered by distance. In this case the computer assumes the last side to be defined by the second and last vertices.

The only restrictions on the polygon are that: (a) for one retrieval run, no more than 1500 vertices may be used; and (b) if column 8 is coded with any of the characters 0–6, the polygon must not intersect itself.

More than one polygon may be coded per computer run. The order of the sets of cards containing these polygons is immaterial if column 8 is coded with 0, 1, 7, or 8. However, for all other codes in column 8, the computer will print out the stations retrieved by the first set, then the stations retrieved out by the second set, etc. The Station Control Card must be coded with the agency or state code (if needed) and the type of retrieval (Column 8) for each separate polygon.

Examples of Retrieval

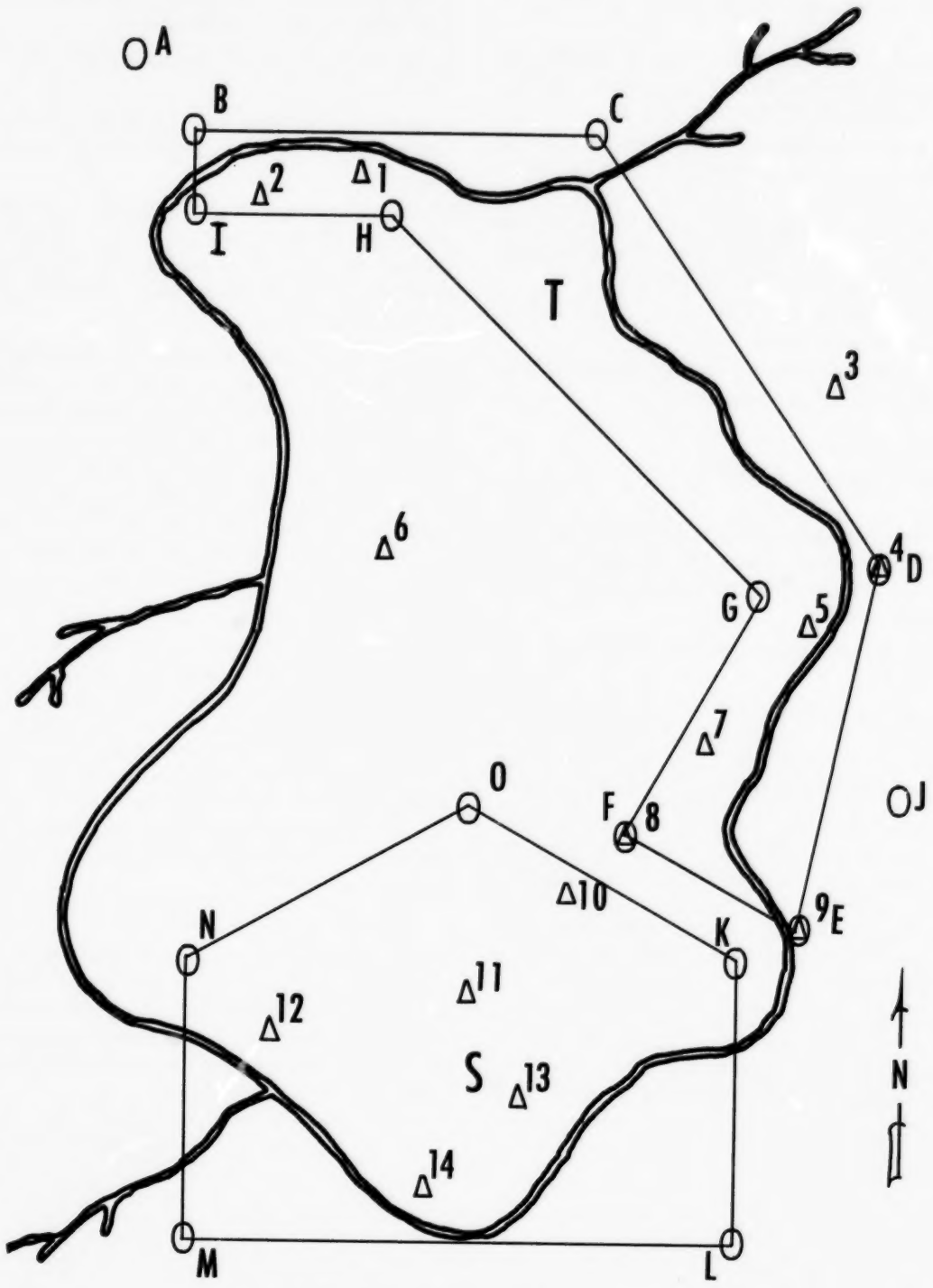
Plate 6 illustrates the different types of retrieval possible using STORET II. In this figure, vertices of the polygons are indicated by circles and letters, while stations are indicated by triangles and numbers. The two polygons will be designated by the letters S and T.

For polygons S and T (S specified before T) the stations shown in Plate 6 will be retrieved in the order shown below if column 8 is coded as indicated. The order in which the polygons are specified is significant only when data from polygons are to be separated.

(a) 0—Stations 4, 5, 9, 7, 8, 10, 13, 11, 14, 1, 12, 2

(b) 1—Stations 14, 13, 12, 11, 9, 10, 8, 7, 5, 4, 2, 1

(c) 2—Stations 10, 13, 11, 14, 12, 4, 5, 9, 7, 8, 1, 2



Example of Retrieval Methods

PLATE 6

(d) 3—Stations 14, 13, 12, 11, 10, 9, 8, 7, 5, 4, 2, 1

(e) 4—Assuming that M and E are the first coded vertices of S and T respectively, stations: 12, 14, 13, 11, 10, 9, 8, 7, 5, 4, 1, 2

(f) 5—Assuming that J and A are the reference points for S and T respectively, stations: 10, 11, 13, 14, 12, 2, 1, 5, 4, 7, 8, 9

(g) 6—Assuming that NO and EF are the first two vertices for S and T respectively, stations: 12, 11, 10, 13, 14, 9, 8, 7, 5, 4, 1, 2

(h) 7—Stations 4, 9, 8

(i) 8—Stations 9, 8, 4

(j) 9—Assuming the order of vertices of T are BCDEFGHI, stations: 4, 9, 8

Date Control Card

The final card needed to control the retrieval routine is the Date Control Card (Figure 8, Appendix I). Coding for this card is shown in the following sections.

1. Card Identification (Column 1)—Always contains a "3".

2. Beginning Date for Retrieval Period (Columns 2–7)—Code the beginning date for the retrieval period in year, month, day order. Data with a date identical to the beginning date will be retrieved.

3. Ending Date for Retrieval Period (Columns 8–13)—Code the ending date for the retrieval period. Data with a date identical to the ending date will be retrieved. For example, if parameters are to be retrieved for calendar year 1959, columns 2–7 will be punched 590000 and columns 8–13 will be punched 591231.

4. Type of Printout (Columns 14–15)—This field is used to specify whether or not the retrieved information is to be printed out and/or stored on magnetic tape. Columns 14 and 15 are coded with:

a. 01—if descriptive paragraph is to be printed for each station retrieved. (Plate 4)

b. 02—if the retrieved water quality data are to be printed. (Plate 5)

c. 04—if the retrieved data are to be stored on a magnetic tape in a format useful for further processing.

5. Number of Originals of the Printout to Be Made (Columns 16–17)—Code with the number of *originals* of the printout desired. The code 01 will produce one original and 3 copies if four-part paper is being used.

6. Upper Depth Limit (Columns 18–21)—Depth to point which is to form the upper (nearest surface) limit for retrieval. Fill with "9's" when only bottom samples are to be retrieved.

7. Lower Depth Limit (Columns 22–25)—Depth to point which is to form the lower (nearest bottom) limit for retrieval. Fill with "9's" when bottom samples are to be retrieved. To retrieve data for all depths, code columns 18–21 with zeros and columns 22–25 with "9's".

8. Feet or Meters (Column 26)—Code with an F for feet or an M for meters. The designated units will be used for the depth limits (Columns 18–25 above) and also on the data printout. Example: If data are to be retrieved for all samples collected at depths between 50 and 100 meters, columns 18–26 would be coded 00500100M. Any data originally stored with units of feet would be automatically converted to meters and all data printed out with units of meters.

9. Column 27 is always blank.

10. Type of Station (Columns 28–35)—This field is used to specify the type(s) of stations to be retrieved. The eight-digit code of an individual type of station or the numeric sum of two or more types of station is entered. The field is filled with sevens if all types are to be retrieved.

APPENDIX I

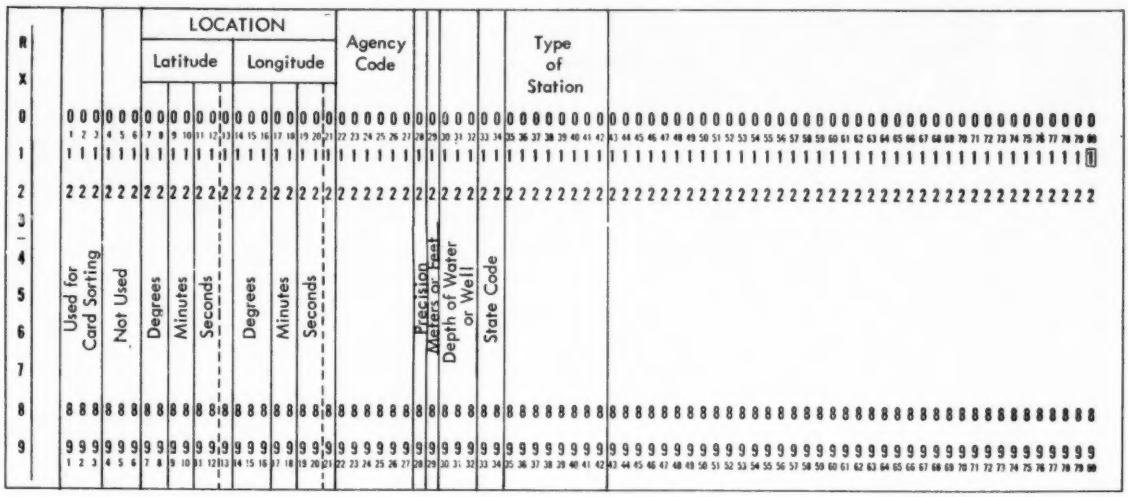


Figure 1: **HEADER CARD I**

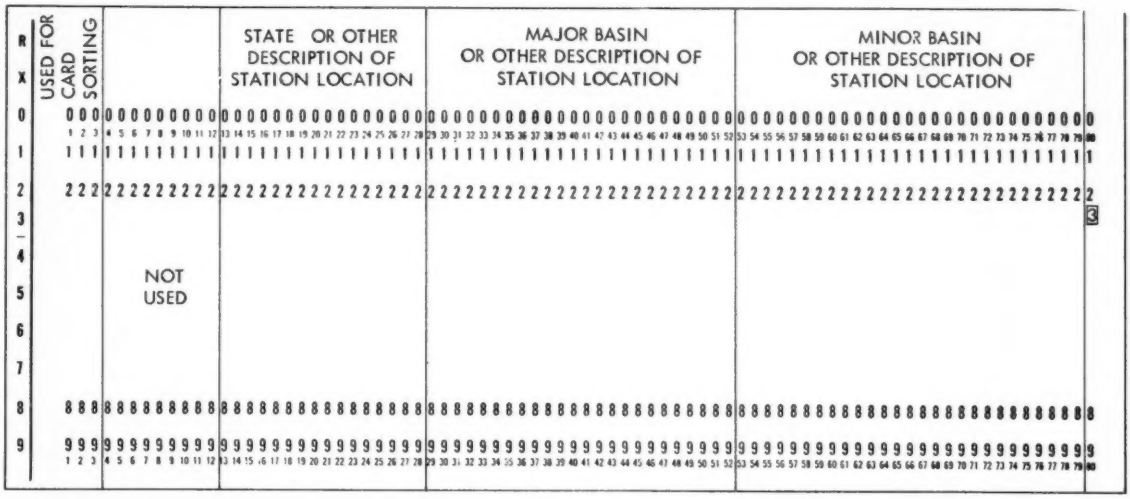

USED FOR CARD SORTING
STATE OR OTHER DESCRIPTION OF STATION LOCATION
MAJOR BASIN OR OTHER DESCRIPTION OF STATION LOCATION
MINOR BASIN OR OTHER DESCRIPTION OF STATION LOCATION
NOT USED

Figure 2: **HEADER CARD III**

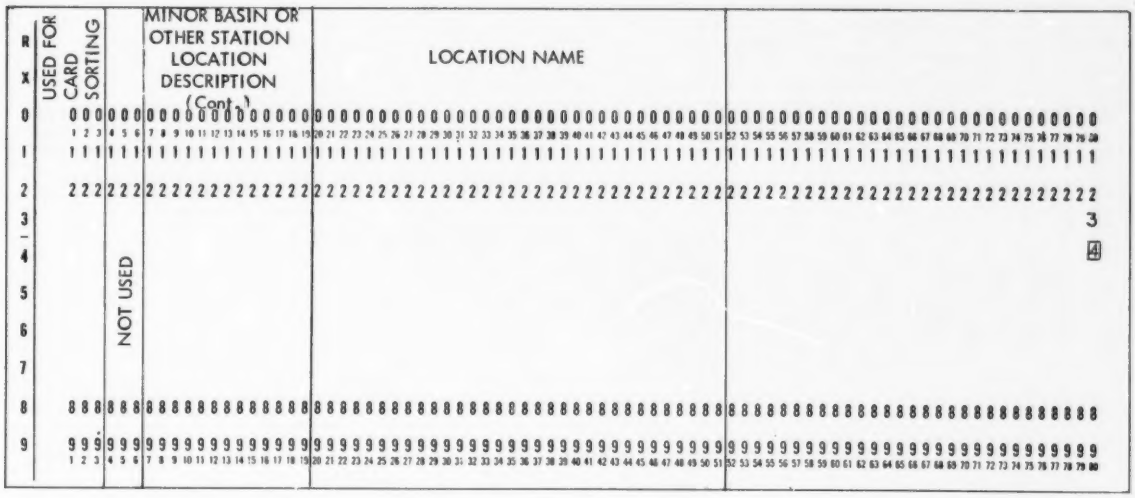


Figure 3: **HEADER CARD IV**

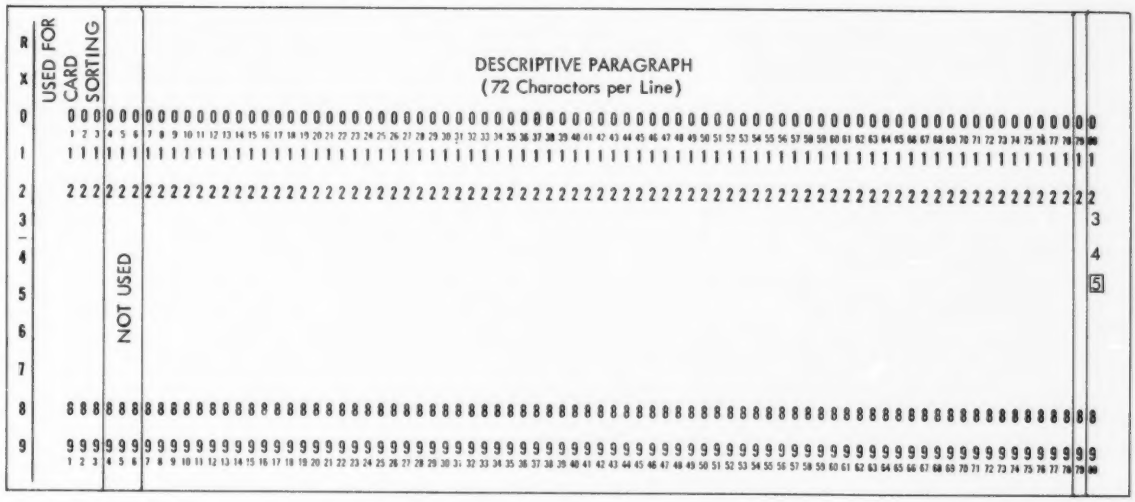


Figure 4: **HEADER CARD V**

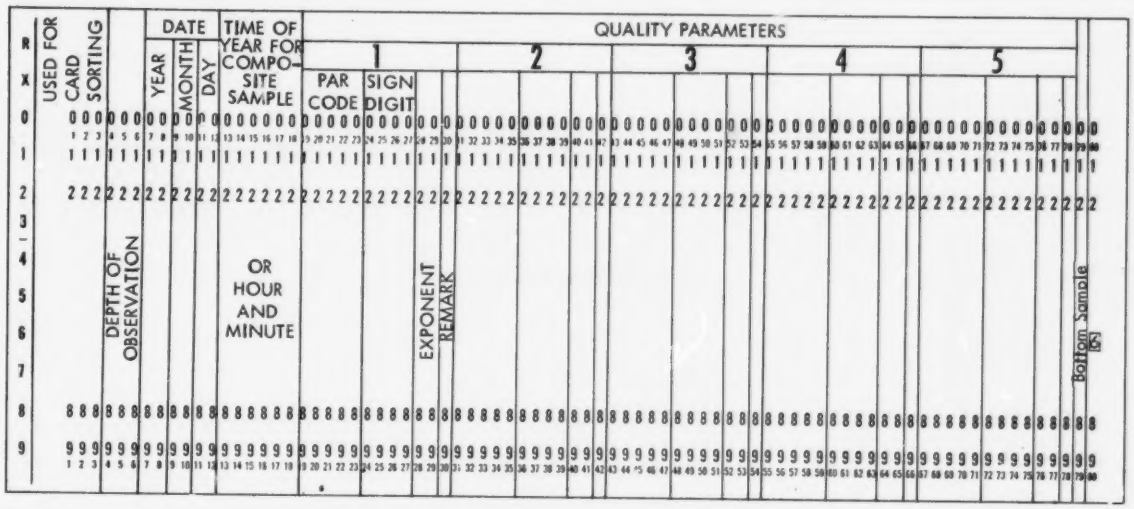


Figure 5: **DATA CARD**

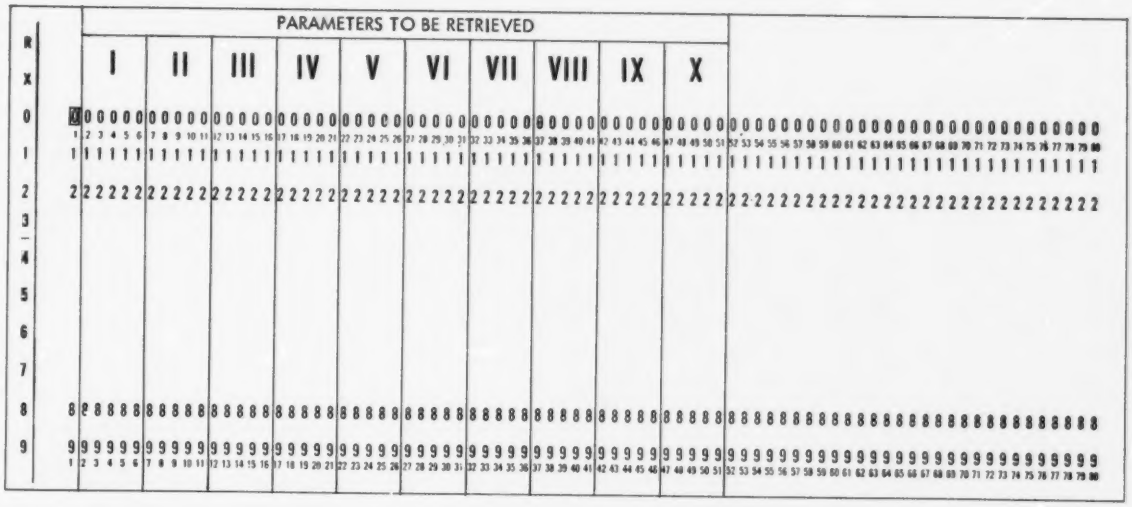


Figure 6: **PARAMETER CONTROL CARD**

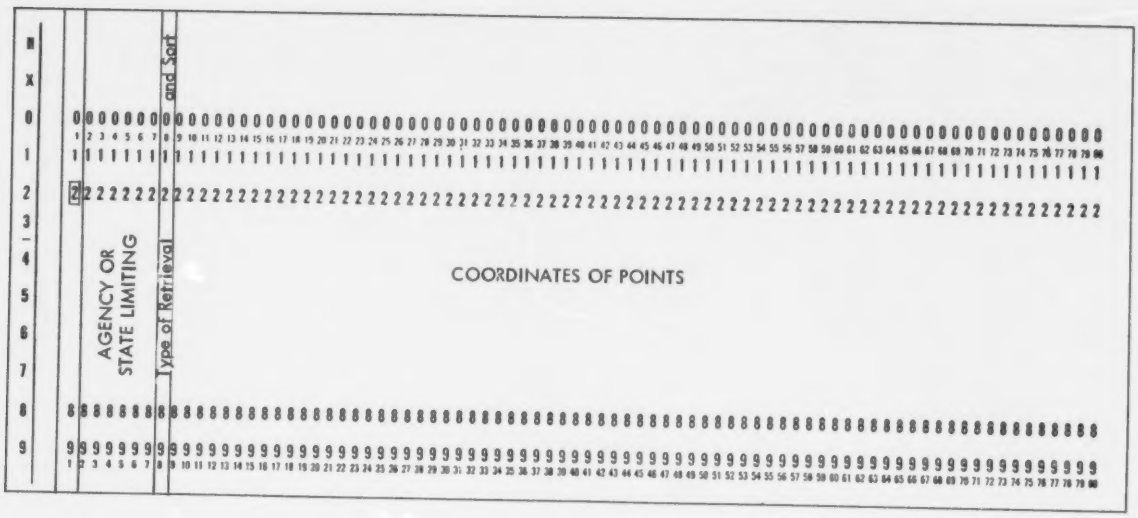


Figure 7: **STATION CONTROL CARD**

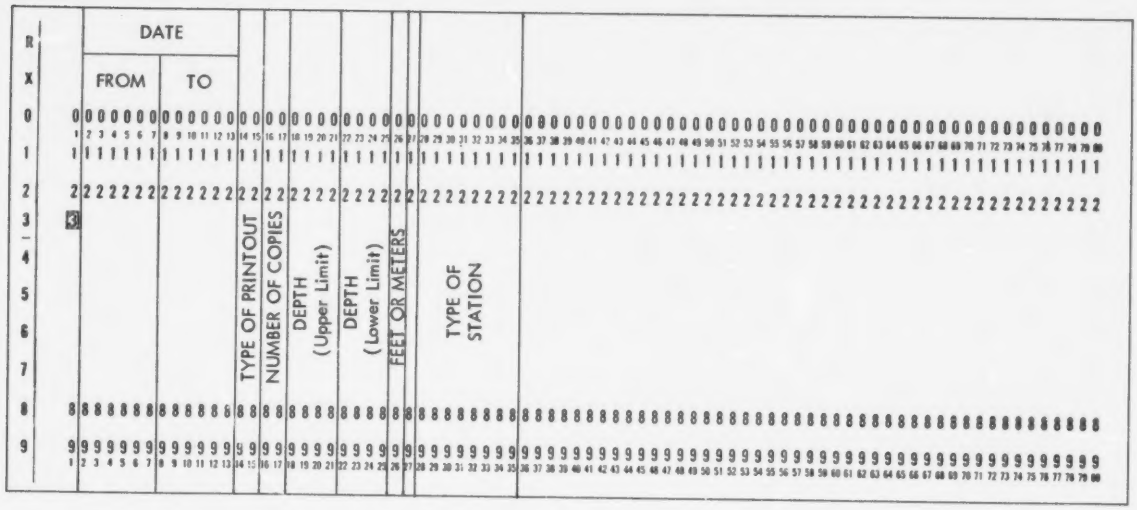


Figure 8: **DATE CONTROL CARD**

APPENDIX II

Length of a Degree of Latitude and Longitude

Lat.	Degree of latitude				Degree of longitude				Lat.
	Nautical miles	Statute miles	Feet	Meters	Nautical miles	Statute miles	Feet	Meters	
°									°
0	59. 701	68. 703	362 753	110 567	60. 109	69. 172	365 226	111 321	0
1	.702	.704	756	568	60. 099	69. 161	365 171	111 304	1
2	. 702	. 704	759	569	60. 072	69. 129	365 003	111 253	2
3	. 703	. 705	762	570	60. 026	69. 077	364 728	111 169	3
4	. 705	. 707	772	573	59. 963	69. 004	364 341	111 051	4
5	59. 706	68. 709	362 782	110 576	59. 881	68. 910	363 845	110 900	5
6	. 708	. 711	795	580	59. 781	68. 795	363 238	110 715	6
7	. 711	. 714	808	584	59. 664	68. 660	362 523	110 497	7
8	. 713	. 717	825	589	59. 528	68. 503	361 696	110 245	8
9	. 717	. 721	844	595	59. 373	68. 325	360 758	109 959	9
10	59. 720	68. 724	362 864	110 601	59. 201	68. 128	359 715	109 641	10
11	. 724	. 729	887	608	59. 011	67. 909	358 560	109 289	11
12	. 728	. 734	913	616	58. 803	67. 670	357 297	108 904	12
13	. 732	. 739	940	624	58. 578	67. 410	355 925	108 486	13
14	. 737	. 744	969	633	58. 335	67. 130	354 449	108 036	14
15	59. 742	68. 750	363 002	110 643	58. 074	66. 830	352 864	107 553	15
16	. 748	. 757	035	653	57. 795	66. 509	351 168	107 036	16
17	. 753	. 763	068	663	57. 498	66. 168	349 367	106 487	17
18	. 760	. 770	107	675	57. 185	65. 807	347 461	105 906	18
19	. 766	. 777	143	686	56. 854	65. 427	345 453	105 294	19
20	59. 773	68. 785	363 186	110 699	56. 506	65. 026	343 337	104 649	20
21	. 780	. 793	228	712	56. 140	64. 605	341 115	103 972	21
22	. 787	. 801	271	725	55. 758	64. 165	338 793	103 264	22
23	. 794	. 810	317	739	55. 359	63. 705	336 365	102 524	23
24	. 802	. 819	363	753	54. 943	63. 227	333 839	101 754	24
25	59. 810	68. 828	363 412	110 768	54. 510	62. 729	331 207	100 952	25
26	. 818	. 837	461	783	54. 060	62. 211	328 474	100 119	26
27	. 827	. 847	514	799	53. 594	61. 675	325 646	99 257	27
28	. 835	. 857	566	815	53. 112	61. 121	322 717	98 364	28
29	. 844	. 868	622	832	52. 614	60. 547	319 688	97 441	29
30	59. 853	68. 878	363 675	110 848	52. 199	59. 955	316 562	96 488	30
31	. 863	. 889	734	866	51. 569	59. 345	313 340	95 506	31
32	. 872	. 900	789	883	51. 023	58. 716	310 023	94 495	32
33	. 882	. 911	848	901	50. 462	58. 070	306 611	93 455	33
34	. 891	. 922	907	919	49. 885	57. 407	303 107	92 387	34
35	59. 902	68. 934	363 970	110 938	49. 293	56. 725	299 508	91 290	35
36	. 911	. 945	364 029	956	48. 686	56. 027	295 820	90 166	36
37	. 922	. 957	091	975	49. 064	55. 311	292 041	89 014	37
38	. 932	. 968	154	994	47. 427	54. 578	288 173	87 835	38
39	. 942	. 980	216	111 013	46. 776	53. 829	284 216	86 629	39
40	59. 953	68. 993	364 281	111 033	46. 110	53. 063	280 171	85 396	40
41	. 963	69. 005	344	052	45. 430	52. 280	276 040	84 137	41
42	. 974	. 017	409	072	44. 737	51. 482	271 827	82 853	42
43	. 984	. 029	472	091	44. 030	50. 668	267 530	81 543	43
44	. 995	. 041	537	111	43. 309	49. 839	263 150	80 208	44
45	60. 006	69. 054	364 603	111 131	42. 575	48. 994	258 691	78 849	45

Length of a Degree of Latitude and Longitude

Lat.	Degree of latitude				Degree of longitude				Lat.
	Nautical miles	Statute miles	Feet	Meters	Nautical miles	Statute miles	Feet	Meters	
°									°
45	60. 006	69. 054	364 603	111 131	42. 575	48. 994	258 691	78 849	45
46	. 017	. 066	669	151	41. 828	48. 135	254 154	77 466	46
47	. 027	. 078	731	170	41. 068	47. 260	249 534	76 058	47
48	. 038	. 090	797	190	40. 296	46. 372	244 843	74 628	48
49	. 049	. 103	862	210	39. 511	45. 468	240 072	73 174	49
50	60. 059	69. 114	364 925	111 229	38. 714	44. 551	235 230	71 698	50
51	. 070	. 127	990	249	37. 905	43. 620	230 315	70 200	51
52	. 080	. 139	365 052	268	37. 084	42. 676	225 328	68 680	52
53	. 090	. 151	115	287	36. 253	41. 719	220 276	67 140	53
54	. 100	. 162	177	306	35. 409	40. 748	215 151	65 578	54
55	60. 111	69. 174	365 240	111 325	34. 555	39. 765	209 961	63 996	55
56	. 120	. 185	299	343	33. 691	38. 770	204 708	62 395	56
57	. 130	. 197	358	361	32. 815	37. 763	199 390	60 774	57
58	. 140	. 208	417	379	31. 930	36. 745	194 012	59 135	58
59	. 150	. 219	476	397	31. 036	35. 715	188 576	57 478	59
60	60. 159	69. 229	365 531	111 414	30. 131	34. 674	183 077	55 802	60
61	. 168	. 241	591	432	29. 217	33. 622	177 526	54 110	61
62	. 177	. 251	643	448	28. 294	32. 560	171 916	52 400	62
63	. 186	. 261	696	464	27. 362	31. 488	166 257	50 675	63
64	. 194	. 270	748	480	26. 422	30. 406	160 545	48 934	64
65	60. 203	69. 280	365 801	111 496	25. 474	29. 314	154 780	47 177	65
66	. 211	. 290	850	511	24. 518	29. 215	148 973	45 407	66
67	. 219	. 298	896	525	23. 554	27 105	143 117	43 622	67
68	. 226	. 307	942	539	22. 583	25. 988	137 215	41 823	68
69	. 234	. 316	988	553	21. 605	24. 862	131 273	40 012	69
70	60. 241	69. 324	366 030	111 566	20. 620	23. 729	125 289	38 188	70
71	. 247	. 331	070	578	19. 629	22. 589	119 268	36 353	71
72	. 254	. 339	109	590	18. 632	21. 441	113 209	34 506	72
73	. 260	. 346	148	602	17. 629	20. 287	107 113	32 648	73
74	. 266	. 353	184	613	16. 620	19. 126	100 988	30 781	74
75	60. 272	69. 359	366 217	111 623	15. 606	17. 959	94 826	28 903	75
76	. 276	. 365	247	632	14. 588	16. 788	88 638	27 017	76
77	. 282	. 371	280	642	13. 565	15. 611	82 425	25 123	77
78	. 286	. 376	306	650	12. 538	14. 428	76 181	23 220	78
79	. 290	. 381	332	658	11. 507	13. 242	69 918	21 311	79
80	60. 294	69. 385	366 355	111 665	10. 472	12. 051	63 629	19 394	80
81	. 298	. 389	375	671	9. 434	10. 857	57 323	17 472	81
82	. 301	. 393	394	677	8. 394	9. 659	51 001	15 545	82
83	. 303	. 396	411	682	7. 350	8. 458	44 659	13 612	83
84	. 306	. 399	427	687	6. 304	7. 255	38 304	11 675	84
85	60. 308	69. 402	366 440	111 691	5. 256	6. 049	31 939	9 735	85
86	. 310	. 403	450	694	4. 207	4. 842	25 564	7 792	86
87	. 311	. 405	457	696	3. 157	3. 633	19 180	5 846	87
88	. 312	. 406	463	698	2. 105	2. 422	12 789	3 898	88
89	. 313	. 407	467	699	1. 052	1. 211	6 394	1 949	89
90	60. 313	69. 407	366 467	111 699	0. 000	0. 000	0	0	90

Table from "American Practical Navigator" 1962 edition, N. Bowditch published by U.S. Navy Hydrographic Office.

APPENDIX III

State Code Numbers

State	*No.*	*State*	*No.*
Alabama	01 and 58	Nebraska	30 and 81
Alaska	02 and 59	Nevada	31
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